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54 Multiple arrangement of internal high pressure forming tools in internal high pressure forming presses

57 The invention relates to a multiple arrangement of internal high pressure forming tools in internal high pressure forming presses, wherein the forming tools are divided into upper tool and lower tool perpendicular to the stroke direction of the forming press. To reduce the locking pressure that a forming press must apply for a plurality of forming tools during the forming cycle, it is proposed that the forming tools be arranged stack-shaped above one another during forming.

The following information is taken from the documents submitted by the applicant.

Description

The invention relates to a multiple arrangement of internal high pressure forming tools in internal high pressure forming presses in accordance with the preamble of Claim 1.

A generic fitting arrangement is known from DE-PS 43 22 061. Therein the forming tools are arranged next to each other in a single forming press, the upper tool being attached to the plunger and the lower tool being attached to the platen. Here the forming tools are not identical but are configured in such a manner that the different hollow bodies arising therein can, in the subsequent assembly, be joined together into one single combination hollow body that is larger and/or longer in relation to the individual component hollow bodies. In contrast to shaping the component hollow bodies using a plurality of individual forming presses, each having a single but different forming tool, the integration of this plurality of presses into a single press saves storage space and cost. Although the forming tools are all connected to a single high-pressure source, they can be controlled individually. It would indeed be possible to operate only a single press with a single forming tool. But after producing a component hollow body, the press would then have to be retooled and equipped with another forming tool fitting the configuration of the previous forming tool. But this is extraordinarily expensive in every respect, there also arising the problem of intermediate storage of already formed parts until the last component hollow part has been formed. One disadvantage of this type of side-by-side arrangement of forming tools into one forming press is that the press must be built very protruding, thereby still requiring significant floor space in spite of the integration of a plurality of presses into one. Moreover the locking pressure that the press must provide for the forming tools that are held under high pressure during forming is very high, because the lifting forces of the separate upper tools add together. For the same reasons, it is necessary to fashion the platen and its base particularly stable to catch the forces operating downwards upon it. Moreover this high locking pressure must be uniformly fed over a large surface, resulting in high costs for apparatuses.

It is the object of the invention to develop a generic fitting arrangement to the effect that the locking pressure to be applied in the forming cycle of a forming press is reduced for a plurality of forming tools.

This object is achieved according to the present invention by the distinctive features recited in Claim 1.

Because of the stacked fitting arrangement of the forming tools inside the press during forming, the forces that drive the lower and upper tool apart upwards and downwards cancel each other within the stack, so that only the locking pressure for a single forming tool is needed. Within the forming press, it is thus possible to arrange a nearly arbitrary number of forming tools in the stack without having to increase the locking pressure of the press. In comparison to the known side-by-side arrangement of forming tools, a much lower locking pressure must therefore be applied. Moreover the stacking of the forming tools permits very compact construction of the press, the press

indeed being built higher than a conventional press but requiring much less floor space, floor space playing a very critical role in the placement of presses. The compact construction furthermore facilitates the introduction of the locking pressure, reducing the cost of apparatuses required for this purpose.

Advantageous embodiments of the invention can be found in the dependent claims. As for the rest, the invention will be explained in more detail below based on exemplary embodiments illustrated in the drawing, the figure providing a perspective view of the fitting arrangement according to invention having two forming tools.

The figure depicts a forming press 1 for the process of internal high pressure forming, the forming press comprising of a stroking plunger 2 and a platen 4 tightly installed on a production [letters missing] floor 3.

An upper tool 6 of an internal high pressure forming tool 8 is rigidly attached to the underside 5 of the plunger 2 and a lower tool 7 of an internal high pressure forming tool 9 is rigidly attached to the top side 6 of the platen 4. The upper tool 6 and the lower tool 7 are each built in the shape of a parallelepiped-shaped die block, the cavities 10 of the two tools 6, 7 located opposite each other.

Two guide rods 11, which hang down vertically toward the lower tool 7, are fastened diagonally opposite each other in the corner areas of the upper tool 6. The fitting arrangement of guide rods 11 on the upper tool 6 permits a structural reduction of forming press 1 perpendicular to the stroke direction. On the end 12 facing the lower tool 7, the guide rods 11 demonstrate a collar 13, which forms a carrier element for a die block 14 that slides along the guide rods 11. In connection with the guide rods 11, the collar 13 represents a simple method of handling, insusceptible to wear, for displacing the die block 14.

Both sides of the die block 14 are shaped in correspondence with the cavities 10 of the upper tool 6 of forming tool 8 and of the lower tool 7 of forming tool 9 and, as a an integrally connected unit of an upper tool and a lower tool, the die block forms the upper tool for the forming tool 9 and simultaneously forms the lower tool for forming tool 8, achieving not only a structural simplification of the fitting arrangement, but also saving space because of the reduction of the overall height of the forming press 1 that this permits. Two vertically extending leadthroughs 15, whose axial position conforms to the guide rods 11, are provided in the die block 14. The guide rods 11 pass through them with play so that the die block 14 can slide along the guide rods 11. The leadthroughs 15 contribute to another structural simplification of the fitting arrangement, because the die block 14 is guided process-safe with only two rods 11. It would also be possible to guide the die block 14 on its outside perimeter, wherein it would be constructionally much more expensive to guarantee reliable guidance, however, because of the necessary enlargement of the number of guide rods 11 compared to guidance by the leadthroughs 15.

The lower tool 7 likewise demonstrates two location holes 16 corresponding to the axis, their diameter being somewhat larger than that of the collar 13 so that the accommodation of the respective collar 13 in the location holes 16 ensures secure closing of forming press 1. It is alternatively possible to equip the underside of die block 14 with an annular recess which is concentric to the leadthroughs 15 and accommodates the entire collar 13.

The cavities 10 are provided here in duplicate and each is configured T-shaped, wherein the two T's with their crossbars are directly adjacent to each other in mirror image.

In regard to the process flow, starting with the open state of forming press 1, two tubular blanks are placed next to each other into the crossbars of the cavities 10 of the lower tool 7. The plunger 2 then descends until the die block 14 rests on the lower tool 7 with perfect fit. The collar 13 of the guide rods 11, which support and hold the die block 14 from below and thus make it descend and rise, thereby dips into the location holes 16 of the lower tool 7. Two more tubular blanks are then placed into the lower tool of die block 14. The plunger 2 descends farther, the guide rods 11 slide through the die block 14 until the upper tool 6 fits into place on the lower tool of the die block, and the guide rods dip completely into the location holes 16. In combination with the upper tool 6 and the lower tool 7, the die block 14 thereby forms from its structure a sandwich-like forming tool because of the stack-like fitting arrangement. In this exemplary embodiment, the location holes 16 must thus demonstrate at least the length of the guide rods 11 with collar 13 minus the thickness of the die block 14.

Two pressure pins 17, which demonstrate a fluid feed hole and are connected to a high pressure source and through which the locking pressure of forming press 1 is applied, are then coupled to both sides of each forming tool 8, 9. The hollow formed by the forming tools 8, 9 in their closed state surrounds the emplaced tubular blanks with small play. The tubular blanks are thereupon filled with hydraulic fluid through the pressure pins 17 and the fluid pressurizes them with high pressure from inside, whereupon the tubular material is blown out through the branches 18 running perpendicular to the T-crossbars. Two feed rams 20, each of which can be displaced by a feed cylinder 19 assigned to them, push the blanks, together with the pressure pins 17, axially from behind against the internal pressure, the two feed rams being arranged on both sides of the forming tools 8, 9 in a rear extension of the pressure pins 17, only one side being illustrated in the exemplary embodiment for simplicity. At the same time and in manner known in the art, flexibly controlled counter-rams support the flangings which are formed by the blowing out into the branches 18.

Following the forming process, the pressure pins 17 are switched to depressurized and the press 1 is again pulled apart for opening, wherein the die block 14 remains resting on the lower tool 7 because of its weight until the collar 13 of the guide rods 11 fits into place on its underside 21 and lifts it and pulls it upwards. The finished tubular T-pieces may be removed from the lower tool of the forming tools 8, 9 after the plunger 2 has reached its starting position.

The multiple arrangement according to invention reduces to three the number of axes of the forming press 1 that need to be controlled for similar workpieces in which a flanging is to be formed, one axis being provided for the counter-rams connected in parallel and one axis each being provided for the feed rams 20. In the present exemplary embodiment, the highly symmetrical process control even makes it possible to reduce the control axes to two because of the parallel connection of the feed rams 20. In this case, each feed ram 20 contains four pressure pins 17, while one counter-cylinder, which controls the displacement of two counter-rams, is provided for each side of the die block 14. Alternatively, it is also possible to equip only one of the feed rods 20 with the four pressure pins 17.

In place of the collar 13, which is provided on the guide rods 11 for holding, lifting, and lowering, it is also possible to provide compression springs for rigid fastening of the guide rods 11 onto the lower tool 7, an approach that yields the same space saving as fastening the guide rods 11 on the upper tool 6 and the corresponding configuration of the location holes 16 in the lower tool 6, the compression springs being arranged in a symmetrical manner, on one end supporting themselves on the lower tool 7 and on the other end on the die block 14 in holding recesses there provided. The upper forming tool 8 is the first to be closed for forming and the last to be to be opened when the press 1 is pulled apart after forming has been completed; the forming tool 9 is opened by the load alleviation of the compression springs when press 1 is opened.

In one advantageous embodiment of the invention, the guide rods 11 can draw in and out like a telescope. This reduces the length of the location holes 16 quite significantly, wherein these may in a space-saving manner be chosen smaller in conformity with a dimensioning of the platen 4 or, depending on the arranged location of the location holes, in conformity with a dimensioning of the plunger 2 in the stroke direction.

Moreover, it is also possible to arrange a plurality of die blocks of identical cavity 10 and identical shape within the stack in the same manner as the die block 14 of the exemplary embodiment, the guide rods 11 demonstrating a plurality of axially spaced collars 13 that hold the different die blocks. In this case, the leadthroughs 15 of the top sides of the die blocks must be extended graduated so that the collar 13 assigned to the upper tool adjacent to it above can dip into the die block to securely close the forming tool of interest. It is obvious that pressure pins 17, which are arranged on the mutual feed rams 20, are assigned to the forming tools that the die blocks form among each other. Here the feed rams 20 and counter rams, possibly even the feed cylinders 19 and counter cylinders, must have their height dimensioned in correspondence with a larger number of die blocks. With the stack arrangement of the die blocks and forming tools that they form, it is possible to advantageously produce a large number of hollow profile parts in one cycle. For compact and simple construction of the fitting arrangement, it is advantageous that the two guide rods 11 for one die block 14 to also be assigned to all other die blocks.

In addition, it is possible to introduce die blocks within the stack, whose cavity on the bottom differs from that of the top, wherein the facing cavities of two directly adjacent die blocks, including the lower tool 7 located at the very bottom and the upper tool 6 located at the very top, are configured to correspond to the progression. But this also requires a plurality of feed cylinders, feed rams, counter cylinders and counter rams that have to be controlled separately from each other because process control is usually different for parts that are to be formed differently.

Claims

1. Multiple arrangement of internal high pressure forming tools in internal high pressure forming presses, wherein the forming tools are divided into upper tool and lower tool perpendicular to the stroke direction of the forming press, which comprises of a stroking plunger and a platen**, characterized in that** the forming tools (8, 9) are arranged stack-shaped one above another.

2. Multiple arrangement according to Claim 1, characterized in that the upper tool (6) located at the very top is fastened to the plunger (2) of the forming press (1) and the lower tool (7) located at the very bottom is fastened to the platen (4), and that at least one die block (14), which in one integrally connected unit simultaneously forms the upper tool for the forming tool directly adjacent above it in the stack and the lower tool for the forming tool directly above it in the stack, is provided therebetween.

3. Multiple arrangement according to Claim 2, characterized in that the plunger (2) of the forming press (1) demonstrates guide rods (11) which project towards its platen (4) and guide the displacement of the respective die block (14) and which demonstrate, separately for each die block (14), carrier elements (13) in the form of collars by means of which the die blocks (14) can be lifted and lowered individually.

4. Multiple arrangement according to Claim 2, characterized in that the plunger (4) demonstrates vertically projecting guide rods (11) that guide the displacement of the respective die block (14), there being provided separately for each die block (14) carrier elements (13) in the form of compression springs, which are symmetrically distributed and on one end support themselves on the underside of the die block (14) and on the other end support themselves on the lower tool directly below in the stack.

5. Multiple arrangement according to one of the claims 3 or 4, characterized in that the die blocks (14) demonstrate vertically running leadthroughs (15) which the guide rods (11) pass through.

6. Multiple arrangement according to one of the claims 3 or 4, characterized in that the lower tool (7) that is tightly connected to the platen (4) demonstrates a

location hole (16) assigned to a respective guide rod (11) and into which the guide rod (11) dips.

7. Multiple arrangement according to Claim 3, characterized in that the guide rods (11) project from the upper tool (6) tightly connected to the plunger (2).

8. Multiple arrangement according to one of the claims 3 or 4, characterized in that the guide rods (11) draw in and out like a telescope.

9. Multiple arrangement according to one of the claims 3 or 4, characterized in that all die blocks (14) are assigned to the same guide rods (11).

There follows 1 page(s) of drawings

Translator's notes:

Patent DE 195 25 085 A1:
The German text for Claim 2 appears to have an error. The text translates as follows:

"Multiple arrangement according to Claim 1, characterized in that the upper tool (6) located at the very top is fastened to the plunger (2) of the forming press (1) and the lower tool (7) located at the very bottom is fastened to the platen (4), and that at least one die block (14), which in one integrally connected unit simultaneously forms the upper tool for the forming tool directly adjacent *above it* [nach oben, column 5, line 39] in the stack and the lower tool for the forming tool directly above it in the stack, is provided therebetween."

Based on the description and drawing, I think that the italicized "above it" should be "below it."